

LIBRARY USE ONLY
NOT FOR DISTRIBUTION

OIL RECOVERY BY CARBON
DIOXIDE INJECTION

Monthly Report for
January, 1979

George P. SanFilippo

PENNZOIL COMPANY
Vienna, West Virginia 26105

JUN 12 1979

PREPARED FOR THE UNITED STATES
DEPARTMENT OF ENERGY

Under Contract No. EF-76-C-05-5301

U.S. DOE-BERC LIBRARY
P.O. BOX 1398
BARTLESVILLE, OK 74003

Printed in the United States of America

Available from

National Technical Information Service

U.S. Department of Commerce

5285 Port Royal Road

Springfield, Virginia 22161

Price: Printed Copy \$3.50; Microfiche \$2.25

"This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States DOE, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights."

TABLE OF CONTENTS

	<u>Page No.</u>
INTRODUCTION	1
WELL WORK	
Producing Wells	1
Carbon Dioxide Injection Wells	3
Back-up Water Injection Wells	3
Observation Well	4
CARBON DIOXIDE INJECTION	6
APPENDIX A	
Graphical History of Production	7
APPENDIX B	
Graphical History of Water Injection	9
FIGURE 1	
Pilot CO ₂ Project Map	5
TABLE I	
Pattern Production History	1
TABLE II	
Injection Performance	2
TABLE III	
Water Injection History	4

INTRODUCTION

This report is the thirty-ninth report on the progress of the Rock Creek carbon dioxide pilot project in Roane County, West Virginia. Designed, developed and operated by Pennzoil Company, this project will demonstrate the feasibility of miscible carbon dioxide oil recovery in the Rock Creek Big Injun Field.

WELL WORK

Producing Wells

The January production for the two center producing wells is listed in Table I.

TABLE I
Pattern Production History

	L. W. Shaffer No. 1					
	<u>BO</u>	<u>BW</u>	<u>MMCF</u>	<u>Hrs.</u>	<u>WOR</u>	<u>GOR, CFPB</u>
November	109	1,315	0.0094	720	12.06	86
December	1	857	0.0008	424	857.00	800
January	0	0	0	0	-	-
Cumulative*	5,356	9,760	2.3054		1.82	430

	L. W. Shaffer No. 4					
	<u>BO</u>	<u>BW</u>	<u>MMCF</u>	<u>Hrs.</u>	<u>WOR</u>	<u>GOR, CFPB</u>
November	17	783	0.0010	605	46.06	59
December	9	768	0.0208	503	85.33	2,311
January	10	2,258	0.0110	685	225.80	1,100
Cumulative*	5,728	4,637	3.1316		0.81	547
Project Cum.	11,084	14,397	5.4370		1.30	491

*As of October 1, 1976

On January 15, 1979 Shaffer No. 4 was treated with a small fracture treatment consisting of 500 gallons of 15% F.E. acid, 150 barrels of treated water and 3,000 pounds of 20/40 sand. This treatment was designed to overcome wellbore damage and increase productivity. The treatment was successful. Currently the well is producing at a rate of 100 to 120 barrels of fluid per day with a near 100% water cut.

An open hole squeeze cement job was attempted on Shaffer No. 1, but problems during the job will necessitate further workover procedures during February.

Table II shows the effective water injection volumes and rates in comparison with fluid withdrawals from each pattern. Effective injection is defined as the amount of fluid that would enter the pattern area based on a radial flow pattern with no interference by the outside injection wells. Also, it is assumed that no water injected into the back-up wells enters the pattern area.

TABLE II

	Shaffer No. 1 Pattern 10.01 Acres	Shaffer No. 4 Pattern 9.64 Acres	Project
Cum. Eff. W.I.-2/1/79, Bbls.	67,957	60,336	128,293
January Eff. Inj. Rate, BPD	67	69	136
January Fluid Withdrawal, BPD	Workover	73	73
Cum. Eff. W.I./B.F. Produced	4	6	5
Cum. Eff. W.I./B.O. Produced	12	11	11
Recovery Factor, STBOPA	535	594	564

The production history for these two wells is graphically presented in Appendix A.

Carbon Dioxide Injection Wells

Total water injection as of February 1, 1979 was 382,720 barrels. The average rate of injection was 70 barrels per day per well (BPD PW) at an approximate average wellhead pressure of 995 psig. In comparison, the average rate in December was 76 BPD PW at an average pressure of 945 psig.

The injection history for each well is listed in Table III.

Back-up Water Injection Wells

Injection into the thirteen back-up wells totaled 1,267,666 barrels as of February 1, 1979. The average injection rate during January was 83 BPD PW at an average wellhead pressure of 1000 psig. In comparison, the average rate in December was 85 BPD PW at an average pressure of 965 psig.

The injection history for the project is graphically presented in Appendix B. Figure 1 is a map of the area encompassed by the pilot project.

TABLE III
Water Injection History

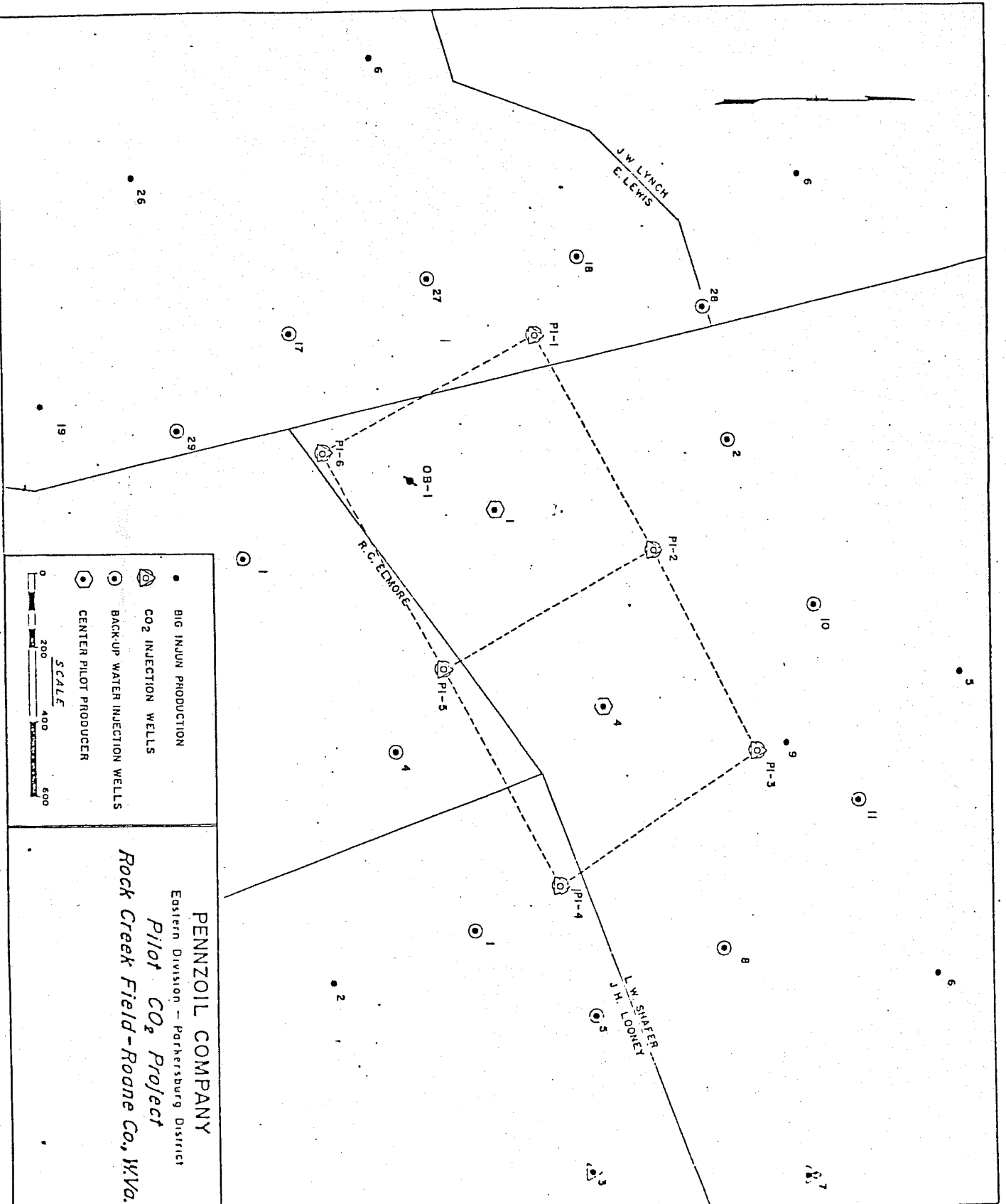
	December Inj., BW	January Inj., BW	Avg. Inj. Rate, BPD	Avg. WHP PSIG	Cum. Inj. 2/1/79
<u>Carbon Dioxide Injection Wells</u>					
E. Lewis P.I. No. 1	2,343	2,303	74	975	63,425
L. W. Shaffer P.I. No. 2	1,757	1,654	53	970	53,457
L. W. Shaffer P.I. No. 3	2,174	2,105	68	1060	40,762
J. H. Looney P.I. No. 4	2,771	2,639	85	1035	70,129
R. C. Elmore P.I. No. 5	2,229	2,143	69	1035	78,607
L. W. Shaffer P.I. No. 6	2,361	2,199	71	910	76,340
Sub-total	13,635	13,043	420	995	382,720
<u>Back-up Water Injection Wells</u>					
R. C. Elmore No. 1	8,900	9,660	312	985	183,031
R. C. Elmore No. 4	1,386	1,254	40	1015	62,504
E. Lewis No. 17	488	529	17	1020	72,802
E. Lewis No. 18	2,100	2,122	68	985	83,449
E. Lewis No. 27	1,278	1,193	38	1025	69,520
E. Lewis No. 28	2,982	1,929	92*	930	79,249
E. Lewis No. 29	1,661	1,288	42	1010	54,320
J. H. Looney No. 1	2,686	2,689	87	1015	125,338
J. H. Looney No. 5	3,737	3,609	116	1010	106,414
L. W. Shaffer No. 2	2,929	2,853	92	975	196,121
L. W. Shaffer No. 8	2,284	2,231	72	965	100,697
L. W. Shaffer No. 10	1,742	1,604	52	1020	62,255
L. W. Shaffer No. 11	1,800	1,765	57	1030	71,846
Sub-total	33,973	32,726	1,085	1000	1,267,666
TOTAL	47,608	45,769	1,505	1000	1,650,386

*21 Days - 3 days tubing job, 7 days changing packer

Observation Well

L. W. Shaffer OB-1 was successfully recemented on January 17, 1979. The 4-1/2" steel casing was perforated at 1981' K.B. through which the well was recemented. The well will be logged using a compensated neutron log and an induction log during February.

Figure 1



CARBON DIOXIDE INJECTION

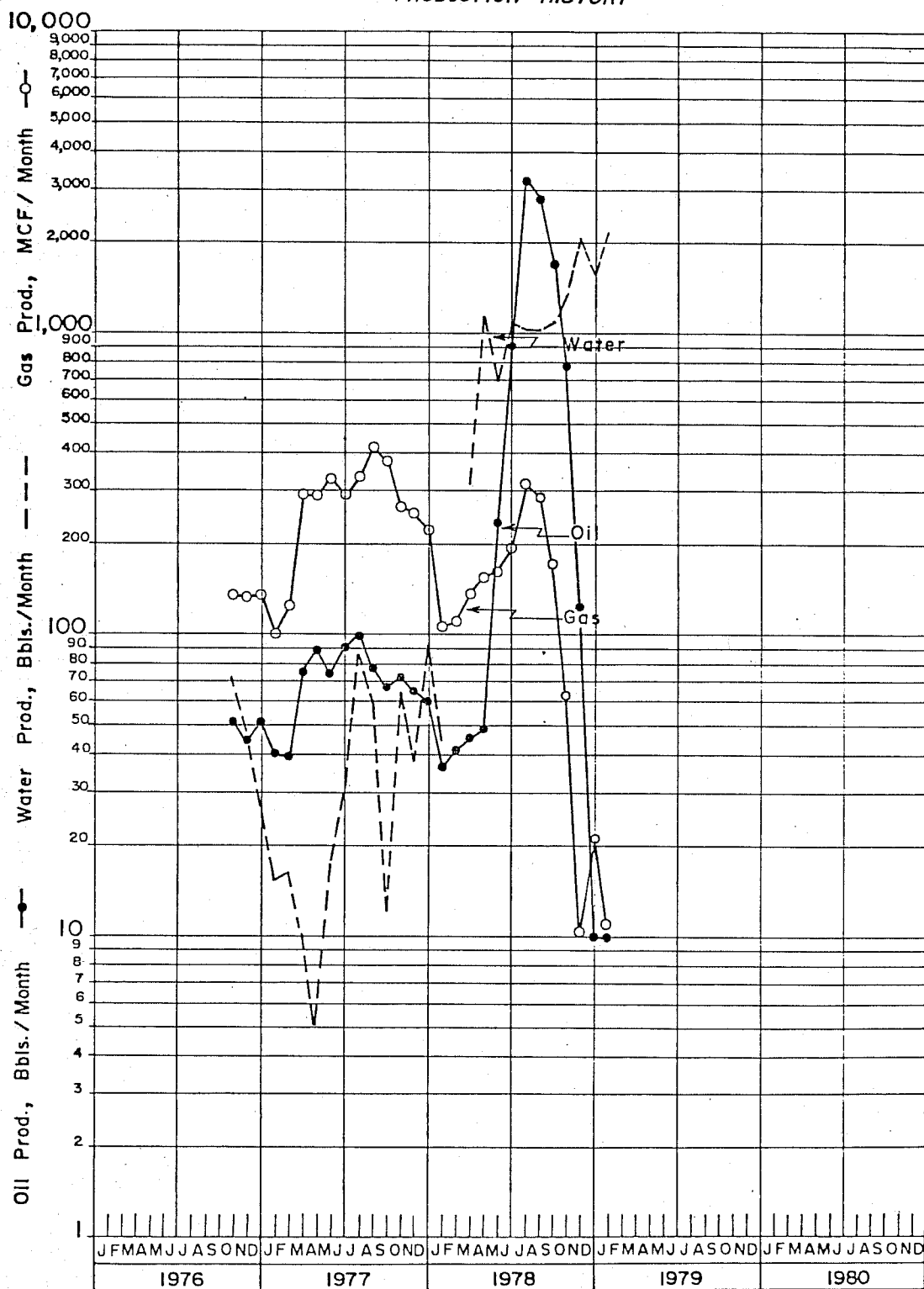
The supply of carbon dioxide at the previously contracted price became questionable when the supplier's feed stock was shut down. New contract negotiations were started and have been completed. The cost of the carbon dioxide will average \$49.80 per ton. Injection of carbon dioxide is now scheduled to begin in February, 1979.

APPENDIX A

Graphical History of Production

ROCK CREEK PILOT CO₂ PROJECT

L. W. SHAFFER NO'S 1 AND 4
PRODUCTION HISTORY



APPENDIX B

Graphical History of Water Injection

ROCK CREEK PILOT CO₂ PROJECT

INJECTION HISTORY

Total Water Injection

